Fraud Detection Through Satellite Imaging

USDA Risk Management Agency

Office of Strategic Data Acquisition & Analysis

1400 Independence Ave, SW

Washington DC 20250

Uses of Remote Sensing

- types of activities that remote sensing can aid in identifying and documenting:
  - *failure to farm* (or plant crop)
  - yield switching
  - poor farming practice
  - *weather related crop injury*
    - hail damage, draught, flood, freeze
  - *disease and insect related failure*

(most of the imagery we deal with will look like this)

ICREST

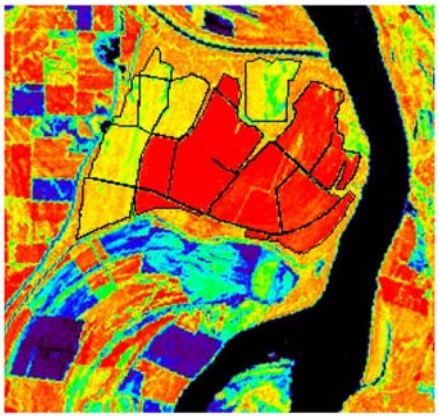
J-Mar
Agri Group

Landsat 5
acquired 8/13/99

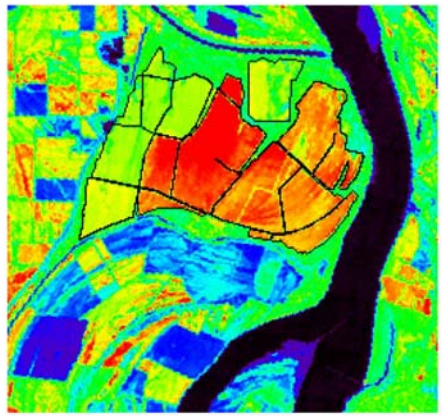
bands 3-2-1

bands 4-3-2

bands 7-4-3



NDVI



tasseled cap
greenness

tasseled cap
brightness

Examples

Example - failure to farm

- case tried in Jonesboro, AR by Mr. Doug Chavez (US District Attorney Eastern District- Arkansas) under the direction of Mr. Jim Johnson and Ms. Lynn Haney

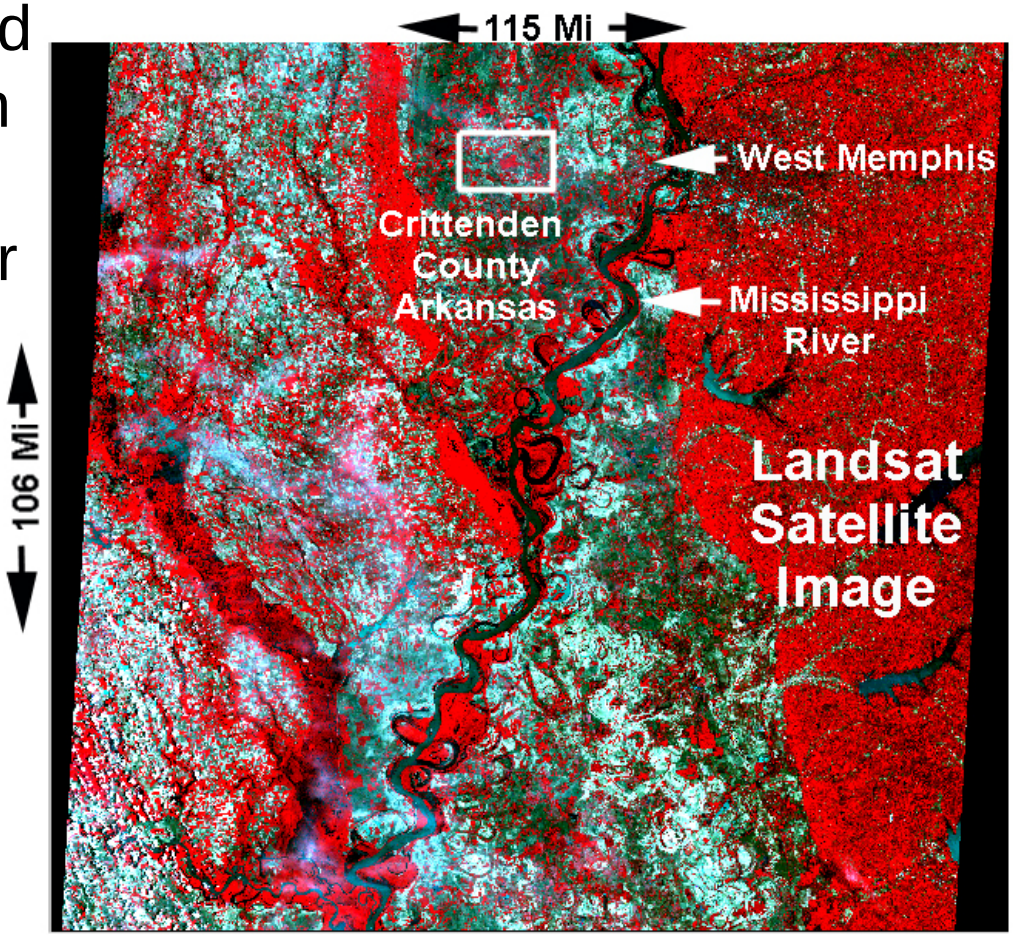
determine if field was:

1. vegetated,
2. fallow, or
3. recently tilled for cotton production.

use satellite image analysis to evaluate field conditions in Crittenden County, Arkansas for May 1993

Imagery used ...

The imagery used in this application was Landsat Thematic Mapper (TM) imagery.

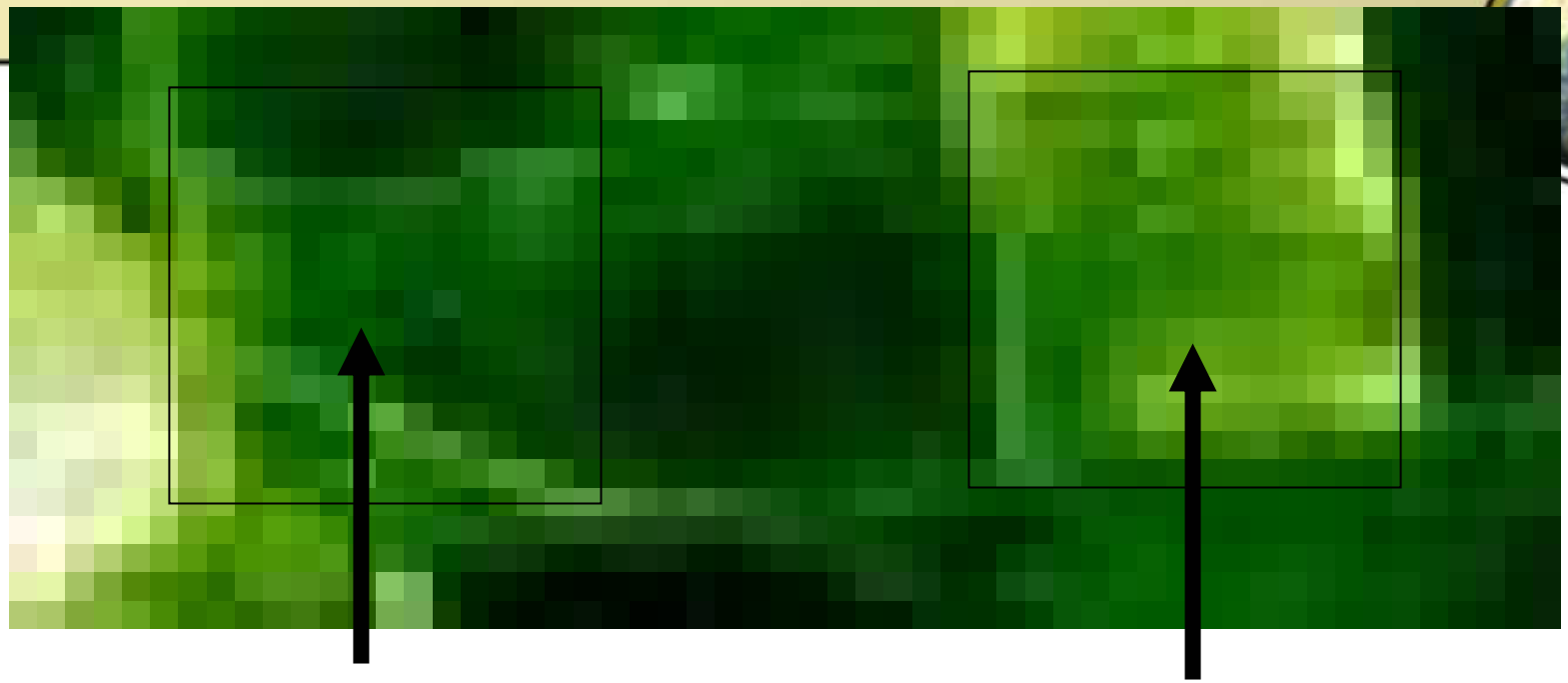


Was cotton planted?

Reed said cotton was planted, but failed later in the year after which another crop was planted.

Remote sensing was used to determine if the fields were planted or if they were even plowed.

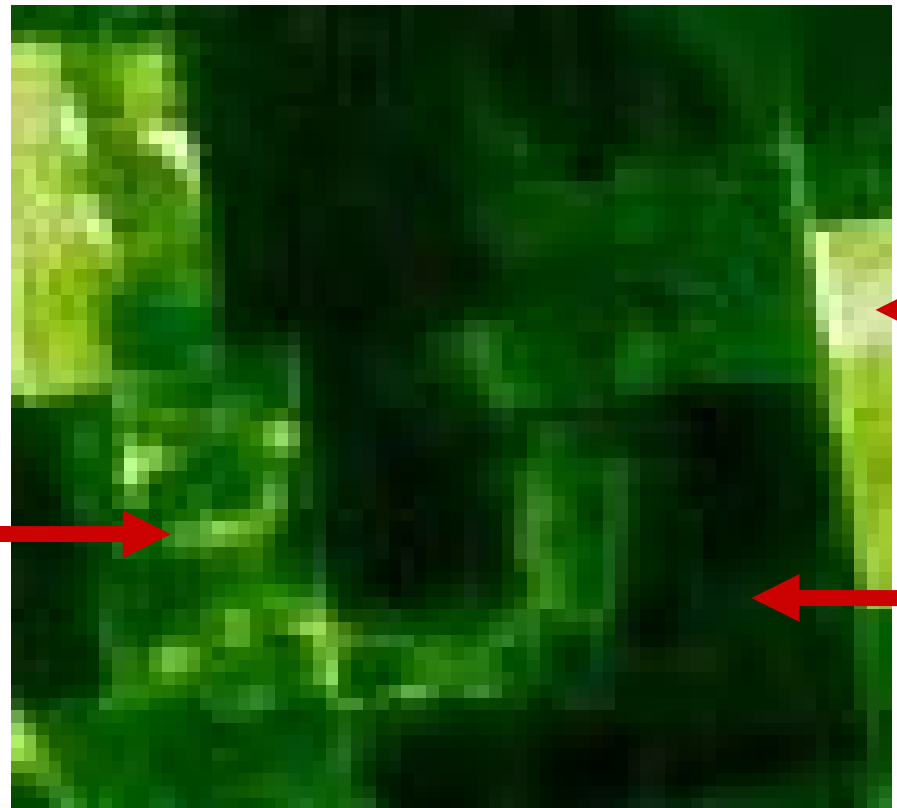
plants = Red Color
soil = Dark Color



32.7 A not plowed 38.6 A

similarly, in these two fields the variable ‘dark’ and light bright green NDVI response indicates that these fields are clearly vegetated

The differences between plowed and prepared fields and unprepared fields are striking in this example. Notice the dark homogeneous NDVI response in the plowed field as compared to the unplowed fields.



Reynolds
Not Plowed
133 A

Needham
Not Plowed
101 A

Needham
Plowed
100 A

paragraphs provide examples of some resolved criminal cases.

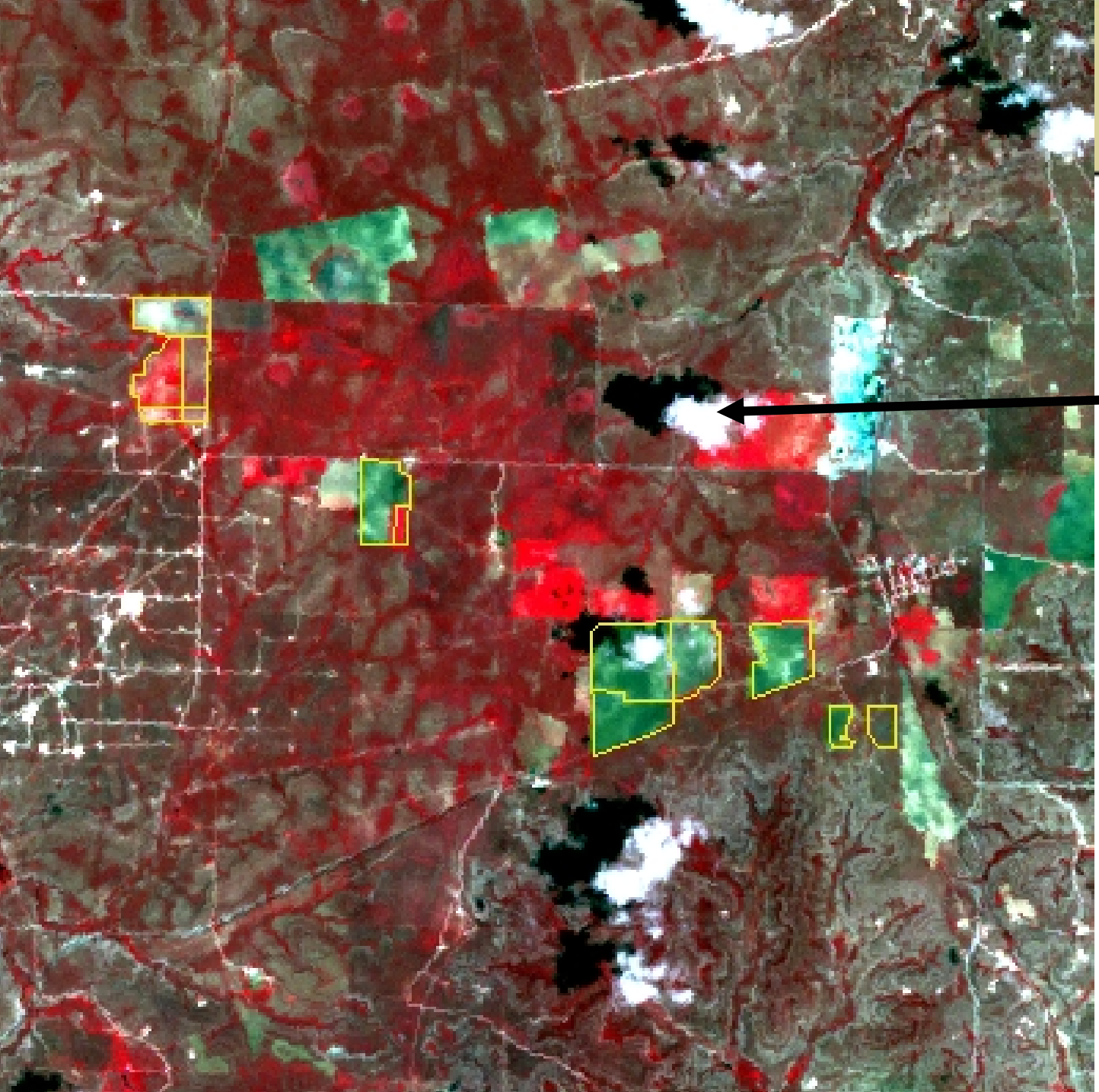
Satellite Imagery Evidence Results in $291,000 Jury Award in Crittenden County, Arkansas

A producer filed a complaint with RMA alleging that another producer and two co-conspirators reported cotton acreage as planted that was not planted. RMA's investigation determined that the acreage was not planted. The Federal Government used satellite imagery for the first time in a crop insurance case. The jury and judge found for the Federal Government and awarded $291,000. RMA assisted the U.S. Attorney for the Eastern District of Arkansas, the OIG, and the FBI in the successful conclusion of this case. The indemnity was $244,930, and the premium was $61,500.

- False clai
  with mul
- CDP refe
  duction c
- Approved
  unit and
  present $

Minnesota Pr

An OIG and SI
a mother and
crop insurance
agreement that
The son is still
Government a
pair.



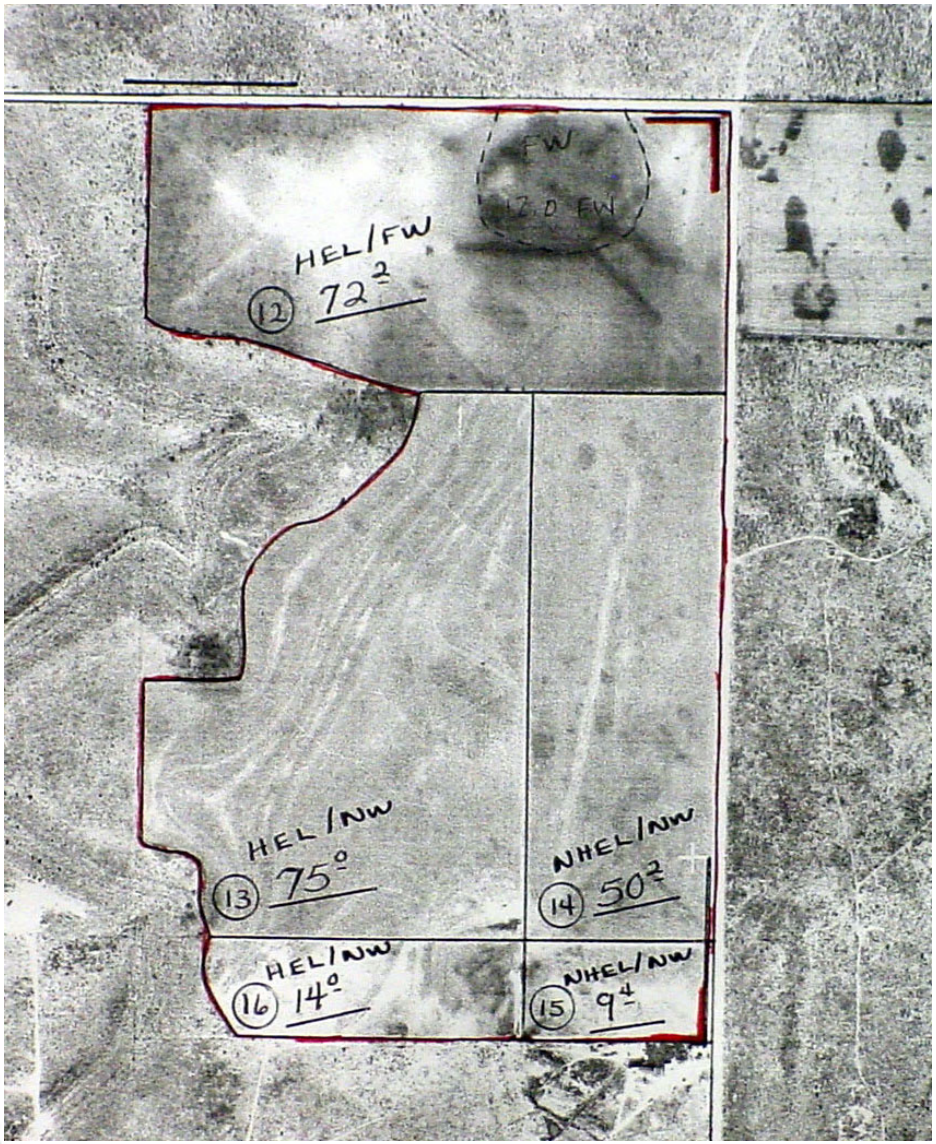
14 July 1999

Clouds &
Cloud Shadow

**USA vs.
L. S. Fullwood**

Landsat 7 ETM+

path/row: 029/038



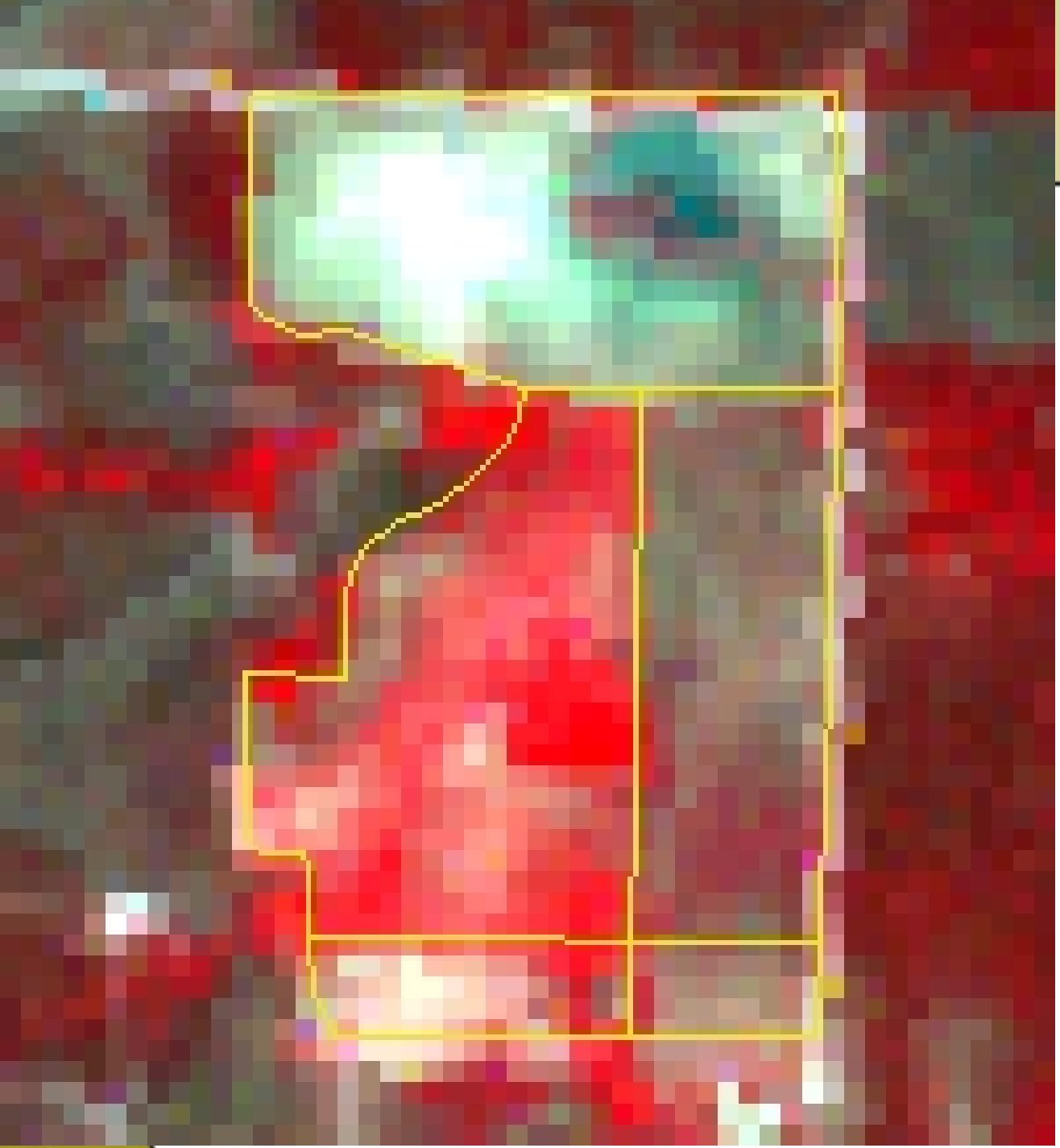
Farm Service
Photo
FSN 576, fields 12-16

4 June 1999

tilled & planted
cotton ~June 25th

FSN 576

Landsat 5 TM
path/row: 029/038



14 July 1999

late June/early July rain event caused cotton to fail (seeds washed out)

crop destroyed by plowing ~July 5th and sorghum planted on destroy date

FSN 576

Landsat 7 ETM+
path/row: 029/038

30 July 1999

sorghum failed with an ~July 25th destroy date (destroy method was plowing crop under)

FSN 576

Landsat 7 ETM+
path/row: 029/038

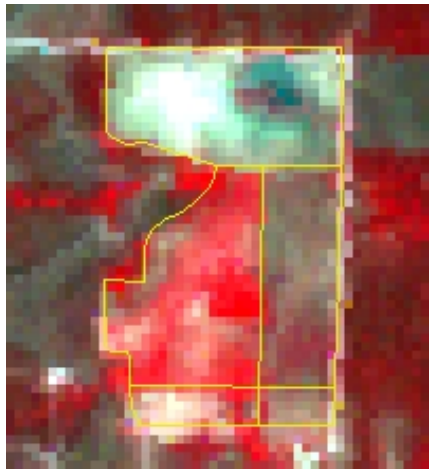
15 August 1999

FSN 576

Landsat 7 ETM+
path/row: 029/038

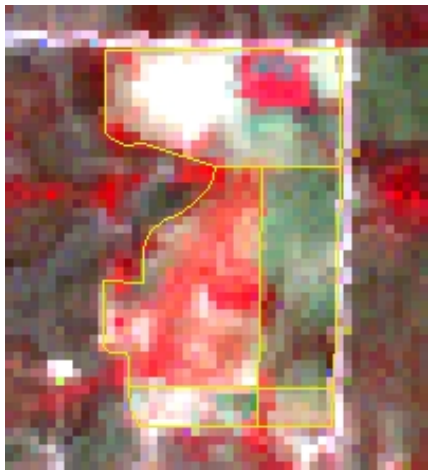
Farm 576

04 June 99



14 July 99

30 July 99

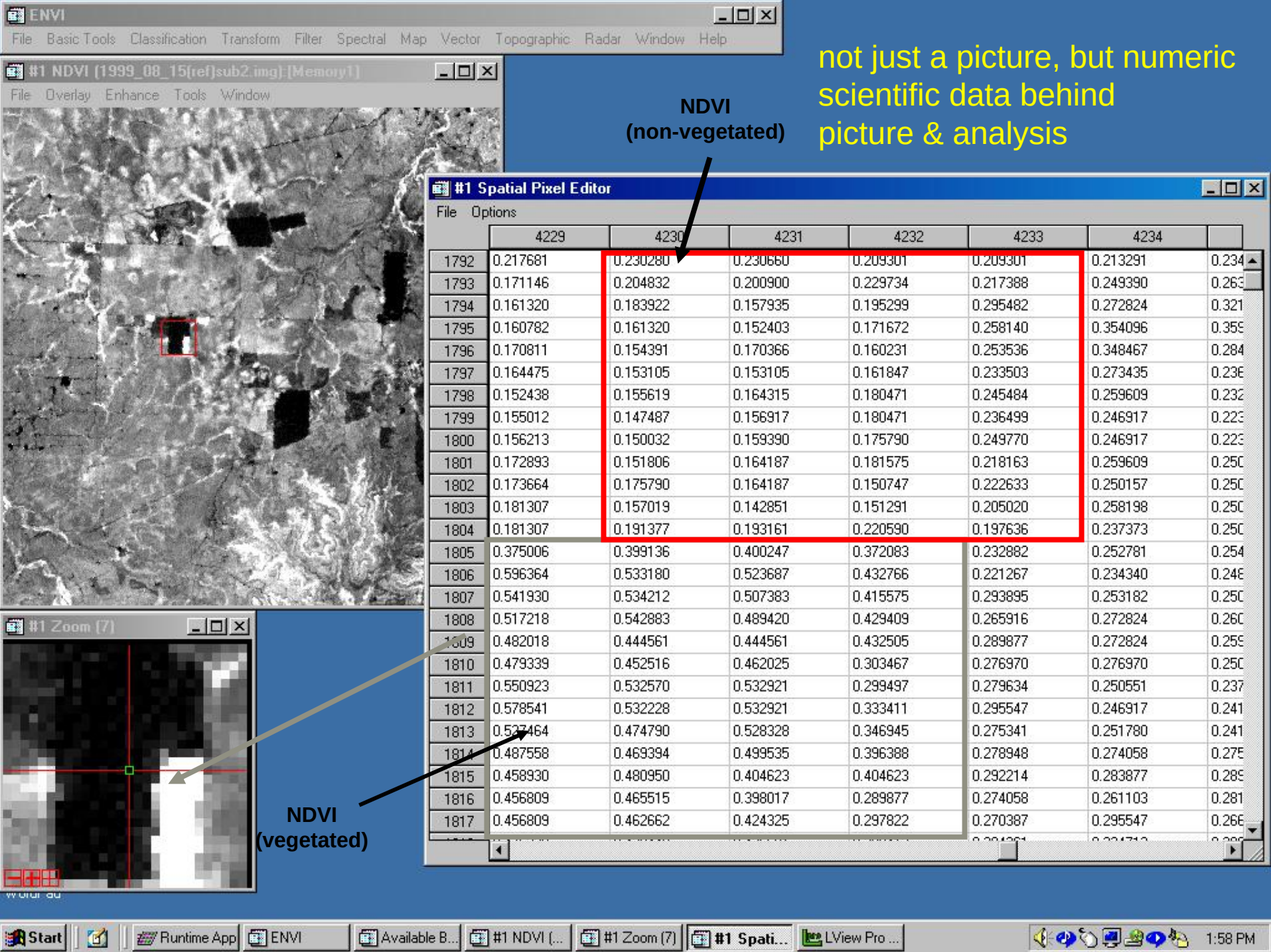


15 Aug 99

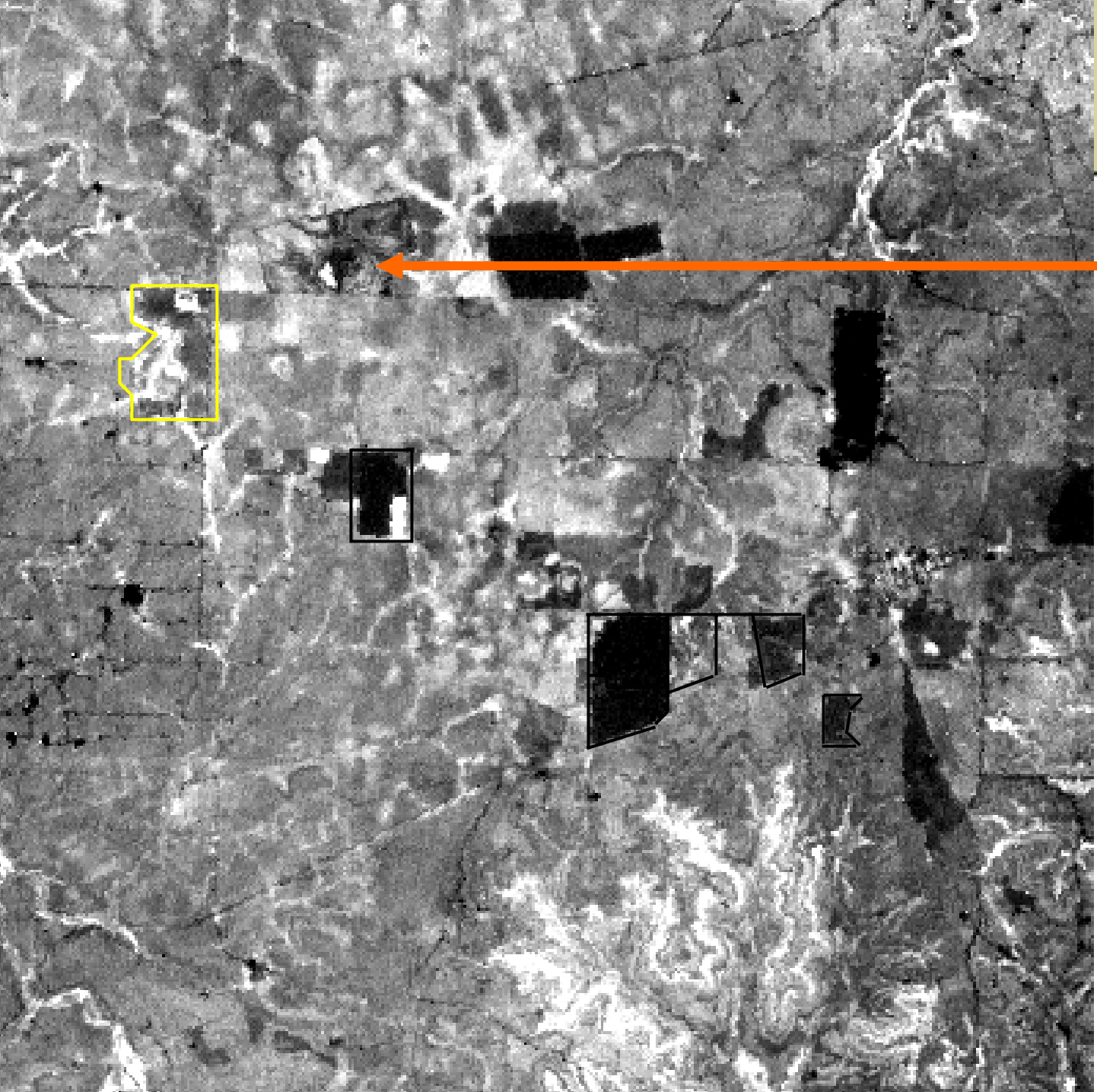
02 Oct 99

Conclusions Farm 576
Fields 12 - 16

- not cultivated by June 4
- vegetation consistent with haygrazer visible by July 14th
- vegetation consistent with haygrazer on field until October 2
- adequate moisture to support crops



	4229	4230	4231	4232	4233	4234	
1792	0.217681	0.230280	0.230660	0.209301	0.209301	0.213291	0.234
1793	0.171146	0.204832	0.200900	0.229734	0.217388	0.249390	0.263
1794	0.161320	0.183922	0.157935	0.195299	0.295482	0.272824	0.321
1795	0.160782	0.161320	0.152403	0.171672	0.258140	0.354096	0.359
1796	0.170811	0.154391	0.170366	0.160231	0.253536	0.348467	0.284
1797	0.164475	0.153105	0.153105	0.161847	0.233503	0.273435	0.238
1798	0.152438	0.155619	0.164315	0.180471	0.245484	0.259609	0.232
1799	0.155012	0.147487	0.156917	0.180471	0.236499	0.246917	0.223
1800	0.156213	0.150032	0.159390	0.175790	0.249770	0.246917	0.223
1801	0.172893	0.151806	0.164187	0.181575	0.218163	0.259609	0.250
1802	0.173664	0.175790	0.164187	0.150747	0.222633	0.250157	0.250
1803	0.181307	0.157019	0.142851	0.151291	0.205020	0.258198	0.250
1804	0.181307	0.191377	0.193161	0.220590	0.197636	0.237373	0.250
1805	0.375006	0.399136	0.400247	0.372083	0.232882	0.252781	0.254
1806	0.596364	0.533180	0.523687	0.432766	0.221267	0.234340	0.248
1807	0.541930	0.534212	0.507383	0.415575	0.293895	0.253182	0.250
1808	0.517218	0.542883	0.489420	0.429409	0.265916	0.272824	0.260
1809	0.482018	0.444561	0.444561	0.432505	0.289877	0.272824	0.259
1810	0.479339	0.452516	0.462025	0.303467	0.276970	0.276970	0.250
1811	0.550923	0.532570	0.532921	0.299497	0.279634	0.250551	0.237
1812	0.578541	0.532228	0.532921	0.333411	0.295547	0.246917	0.241
1813	0.537464	0.474790	0.528328	0.346945	0.275341	0.251780	0.241
1814	0.487558	0.469394	0.499535	0.396388	0.278948	0.274058	0.275
1815	0.458930	0.480950	0.404623	0.404623	0.292214	0.283877	0.289
1816	0.456809	0.465515	0.398017	0.289877	0.274058	0.261103	0.281
1817	0.456809	0.462662	0.424325	0.297822	0.270387	0.295547	0.266



15 August 1999

Robert Williams Cotton

NDVI

Landsat 7 ETM+
path/row: 029/038

United States Attorney
Northern District of Texas

1100 Commerce St., 3rd Fl.
Dallas, Texas 75242-1699

Telephone (214) 659-8600
Fax (214) 767-0978

FOR IMMEDIATE RELEASE
CONTACT: 214/659-8707

DALLAS, TEXAS
JULY 12, 2002

Nolan County Farmer Sentenced to More than Three Years in Federal Prison

United States Attorney Jane J. Boyle announced today that Lea Scott Fullwood of Roscoe, Texas, was sentenced this morning by U.S. District Judge Sam R. Cummings in Lubbock, Texas, to 41 months imprisonment and ordered to pay $234,656.00 in restitution to the U.S. Department of Agriculture (USDA), following his April federal conviction on charges relating to false claims he made to USDA's Federal Crop Insurance Corporation and Risk Management Agency. After an almost two-week jury trial and two days of deliberations, the jury found Fullwood guilty on eight counts of making a false claim to the government, four counts of mail fraud, nine counts of making false statements and one count of conspiracy. The government proved at trial that Fullwood never planted the cotton and grain sorghum for which he submitted the false claims.

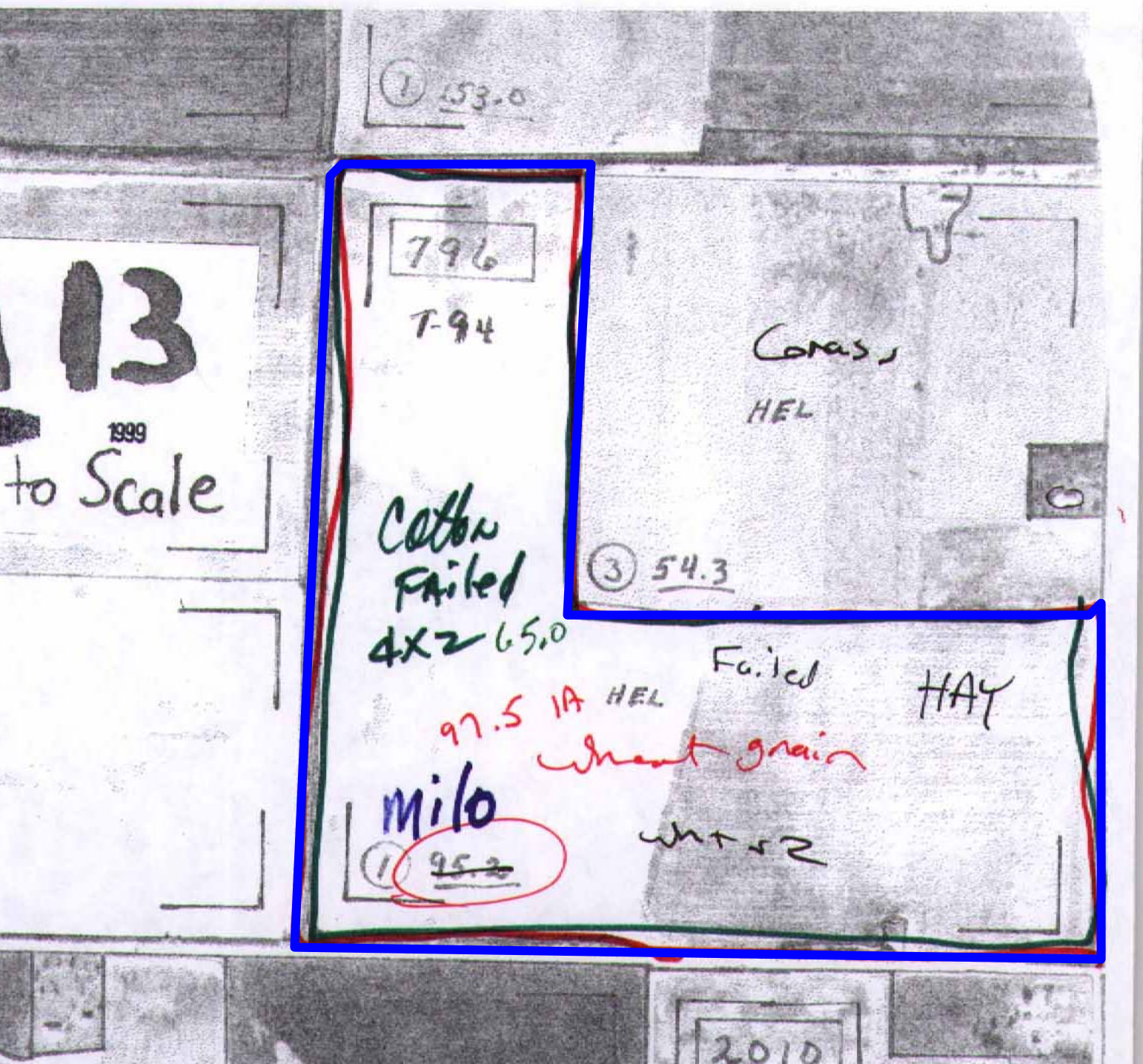
Lea Scott Fullwood is the sixth person convicted in connection with crop insurance fraud in Nolan County. Darren Randell Jeffrey of McCaulley, Texas, a former crop loss adjuster for Fireman's Fund Insurance Company, was sentenced in August 2001 to 24 months imprisonment and ordered to pay $685,772 in restitution to the USDA following his guilty plea to making false claims to USDA's Federal Crop Insurance Corporation and Risk Management Agency. Late last year, Roscoe, Texas, producers, Keith Johnson, Michael John Massey and Gaines Hunter Price, were each sentenced to one year and one day imprisonment following their guilty pleas to the same charge. Ivan Jay Krejci, also of Roscoe, pled guilty to the same charge, but was sentenced to15 months imprisonment. In addition, each defendant was ordered to pay substantial restitution to the USDA.

The fraudulent claims they submitted were paid and reimbursed under the Federal Crop Insurance Corporation's crop insurance program. The falsified appraisals supported subsequent claims filed by the same Nolan County producers to crop disaster program payments totaling more than $400,000.

The convictions are the result of an extensive federal grand jury investigation led by the U.S. Attorney's Office and USDA's Office of Inspector General (OIG) and Risk Management Agency (RMA). U.S. Attorney Boyle praised USDA's OIG and RMA for their thorough work in the case, which included conducting numerous interviews with Nolan County producers and individuals involved in the cotton and grain sorghum industries. She also thanked the many Nolan County producers who cooperated with authorities in this investigation by engaging in candid interviews about fellow Nolan County producers and by not turning a "blind eye" to this widespread fraudulent scheme. Ms. Boyle noted that this investigation will continue and added that she anticipates additional prosecutions.

FSN 796 T- 94 Field 1A

- **Cotton**
  - planted 6/15/1999
  - NOL 6/25/1999
  - 65 Acres

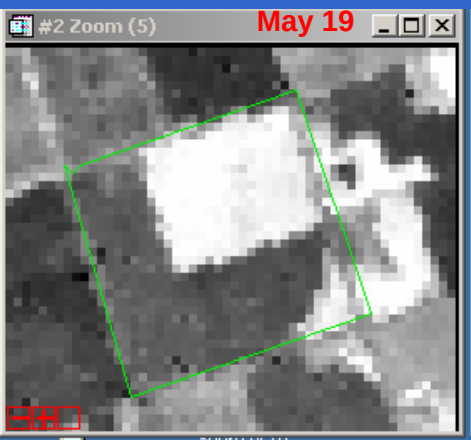


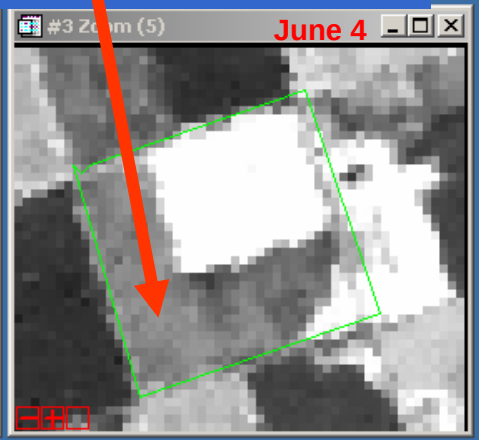
796 T-94
FSA map

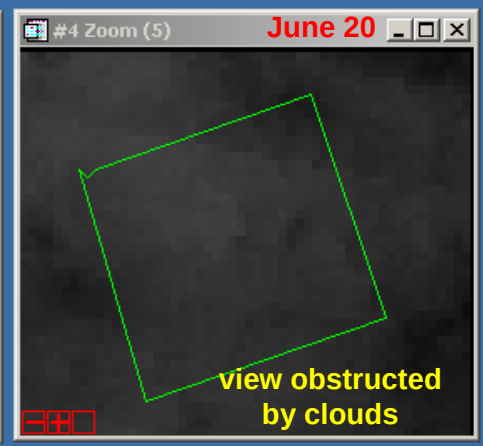
FSN 796

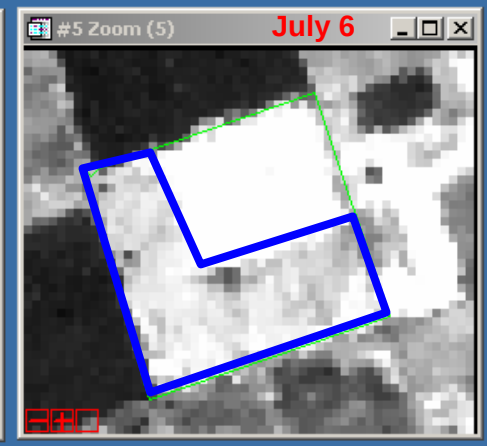
Satellite Images
Counts 4 & 16

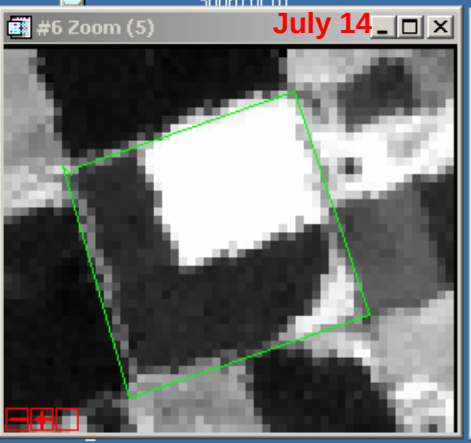
June 4
Developing vegetation

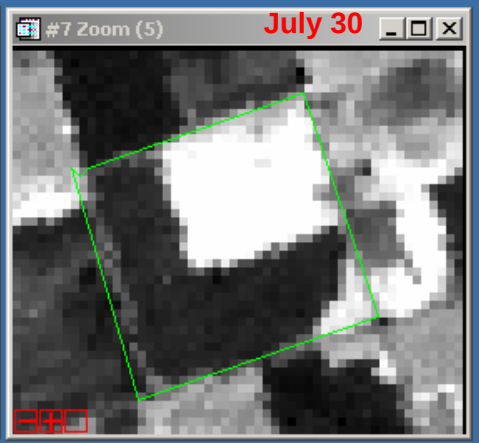


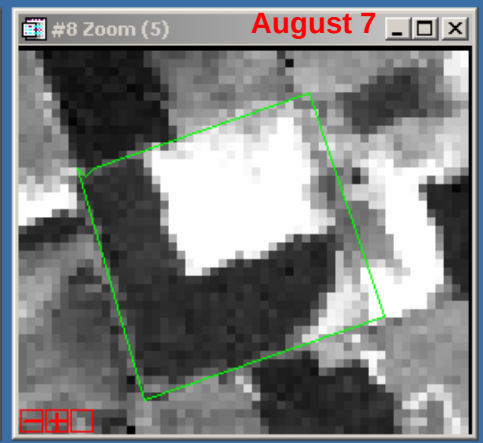


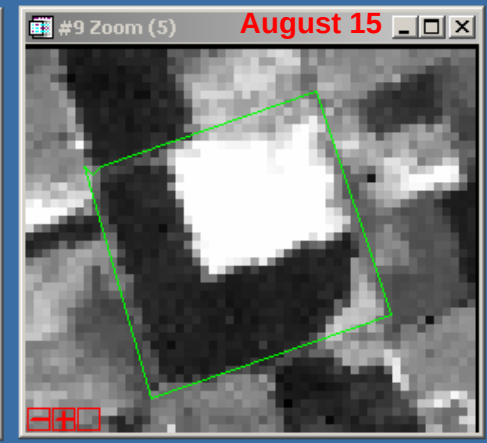


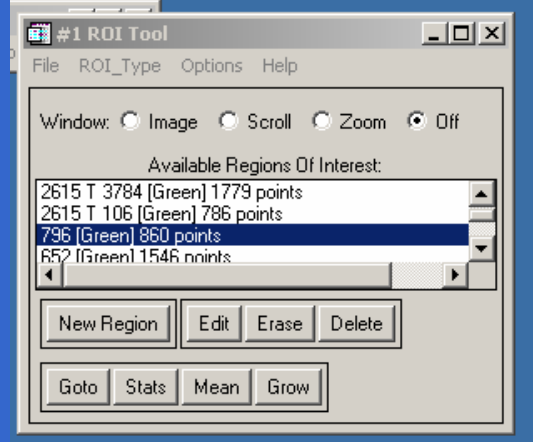


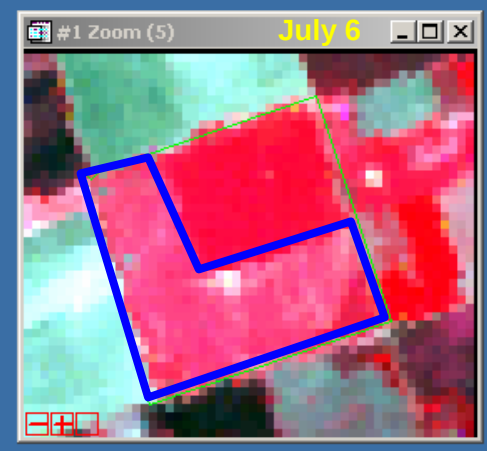










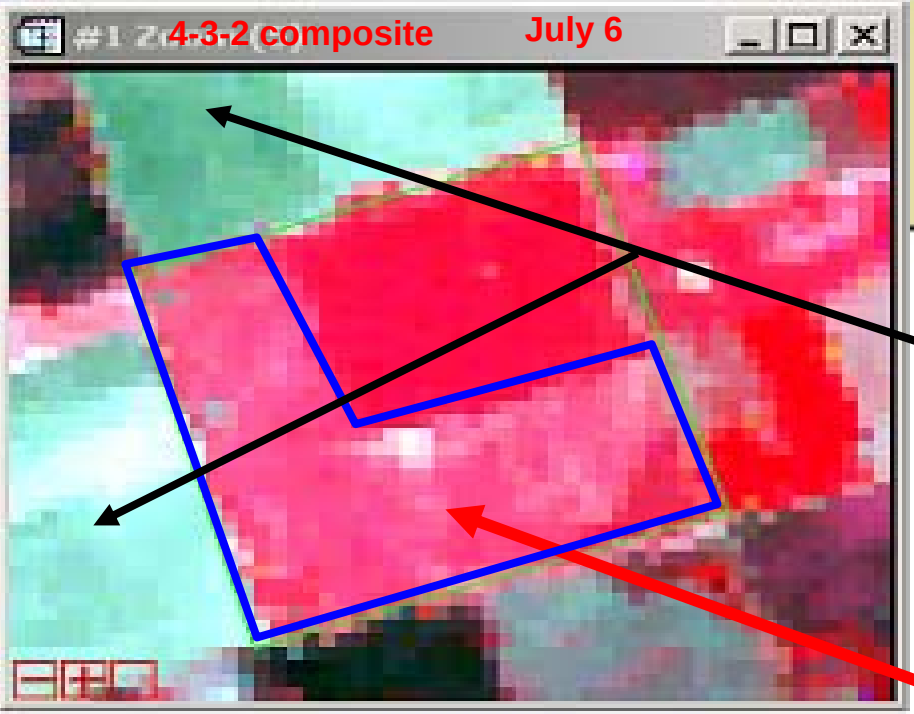


NDVI: White - Vegetation Black - Soil

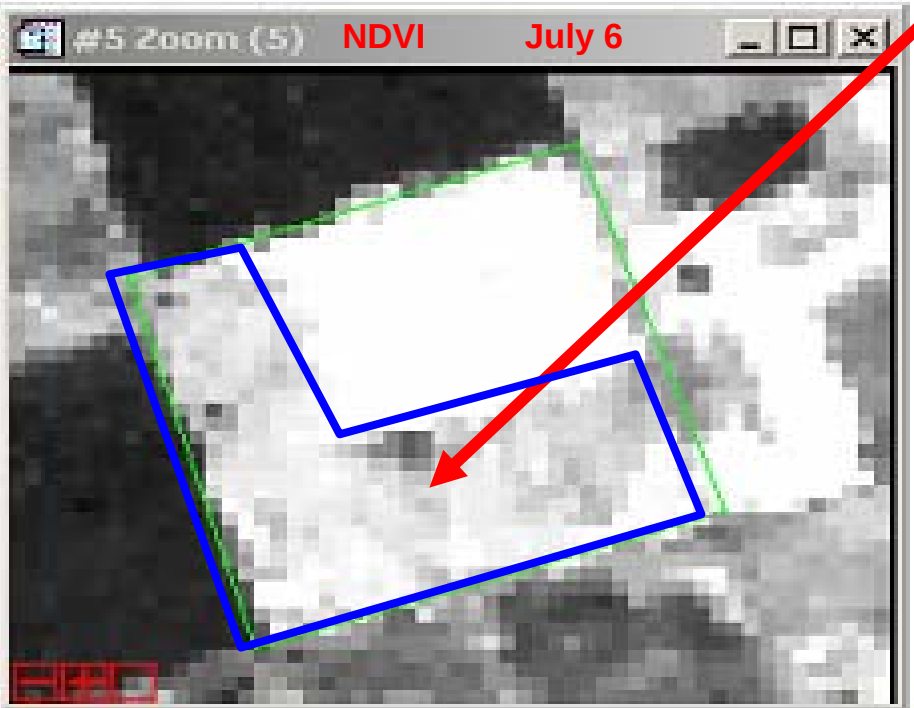
FSN 796 conclusions

- strong vegetative signal consistent with grass or other high-density fast growing crop on July 6th planted before May 19th
- vegetative signal could not have resulted from cotton planted on 6/15 or grain sorghum on 6/29 (as indicated by producer)
- plow-down took place sometime between July 6th and July 14th

FSN 796



Plowed fields. This is what 796 should have looked like if recently plowed and planted.



Well developed crop consistent with a grass crop or perhaps haygrazer on 7/6/99. **Cotton could not have been planted in this field**.

FSN 796 Photo

It was reported photograph acquired on 8/4/99 from SW part of farm, facing NE. Crop residue had appearance of grazed wheat and no evidence of cotton.

Objective of Raisin Infrared Aerial Photography

- WRCO initiated a project involving the remote imaging of approximately 400,000 acres of raisin vineyards located in parts of Fresno and Madera Counties, California
- The allegations were that insureds would attempt to abuse the program due to low prices, heavy yields causing thin skins easily damaged by rain, labor shortages, etc.
- Deterrence is our main objective

Infrared Aerial Photography

- Infrared Aerial Photography has proven useful in crop year 2002
- No new projects in 2003

Aerial Infrared Program:
Raisins, 2002

Field #1

North end of the vineyard with raisins still on trays.

South end of the vineyard where raisins have been picked up.

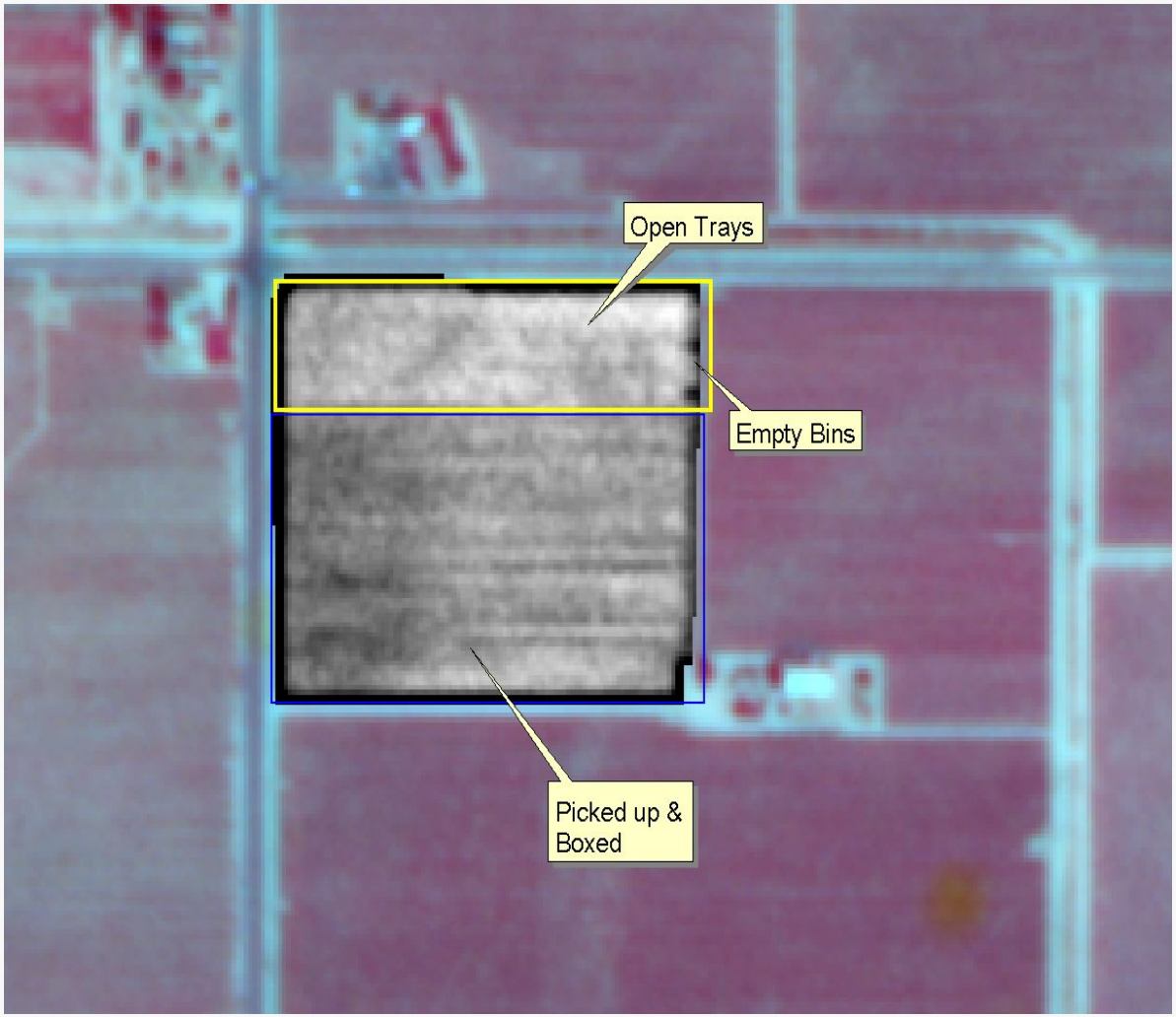
* The next two slides will show the infrared images of this vineyard.

Aerial Infrared
Program: Raisins, 2002

- **Infrared Image**
- The upper 1/3 of the
- vineyard appears darker
- in this image because the
- raisins on the trays absorb
- more light from the “red
- band.”

- The lower portion appears
- lighter because the raisins
- have been picked up and
- the soil is reflecting more
- red light.

Aerial Infrared Program:
Raisins, 2002



Normalized Difference Vegetative Index (NDVI)

NDVI is the ratio of infrared light to red light. As more red light is being absorbed by an object, the lighter the image of that object will appear.

Because there are raisins on the ground in the upper 1/3 of vineyard, the image appears lighter because it reflects a lower level of red light (more red light absorbed).

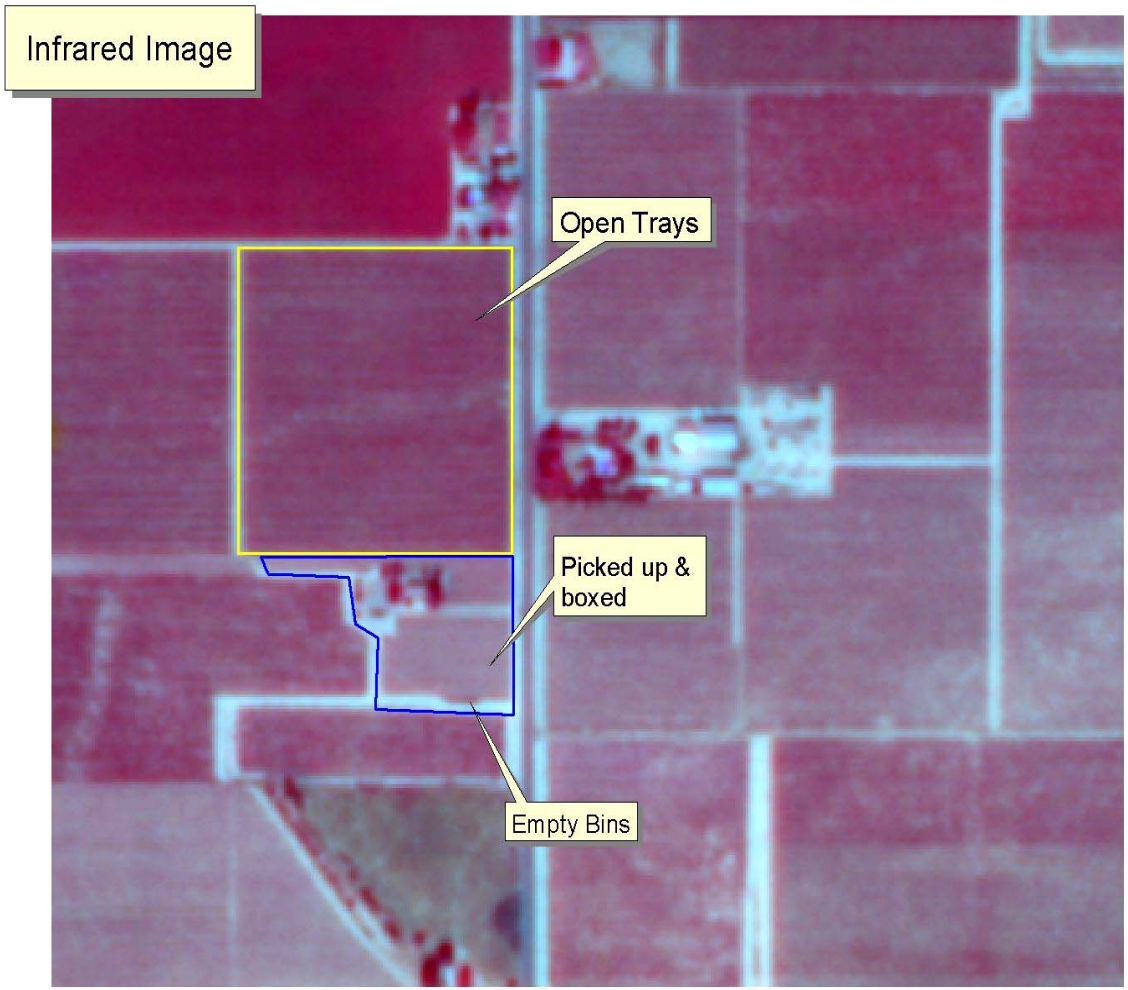
Lower portion is darker because the bare ground reflects more light.

Aerial Infrared Program:
Raisins, 2002

Field #2

This picture is looking westward, showing where the picking crew stopped picking up raisins (row 64). The next three slides will show the infrared images for this vineyard and this break between raisins that have been picked up and here where they are still on trays in the field. The rows to the south (left) of this row have been picked up and the raisins removed from the field.

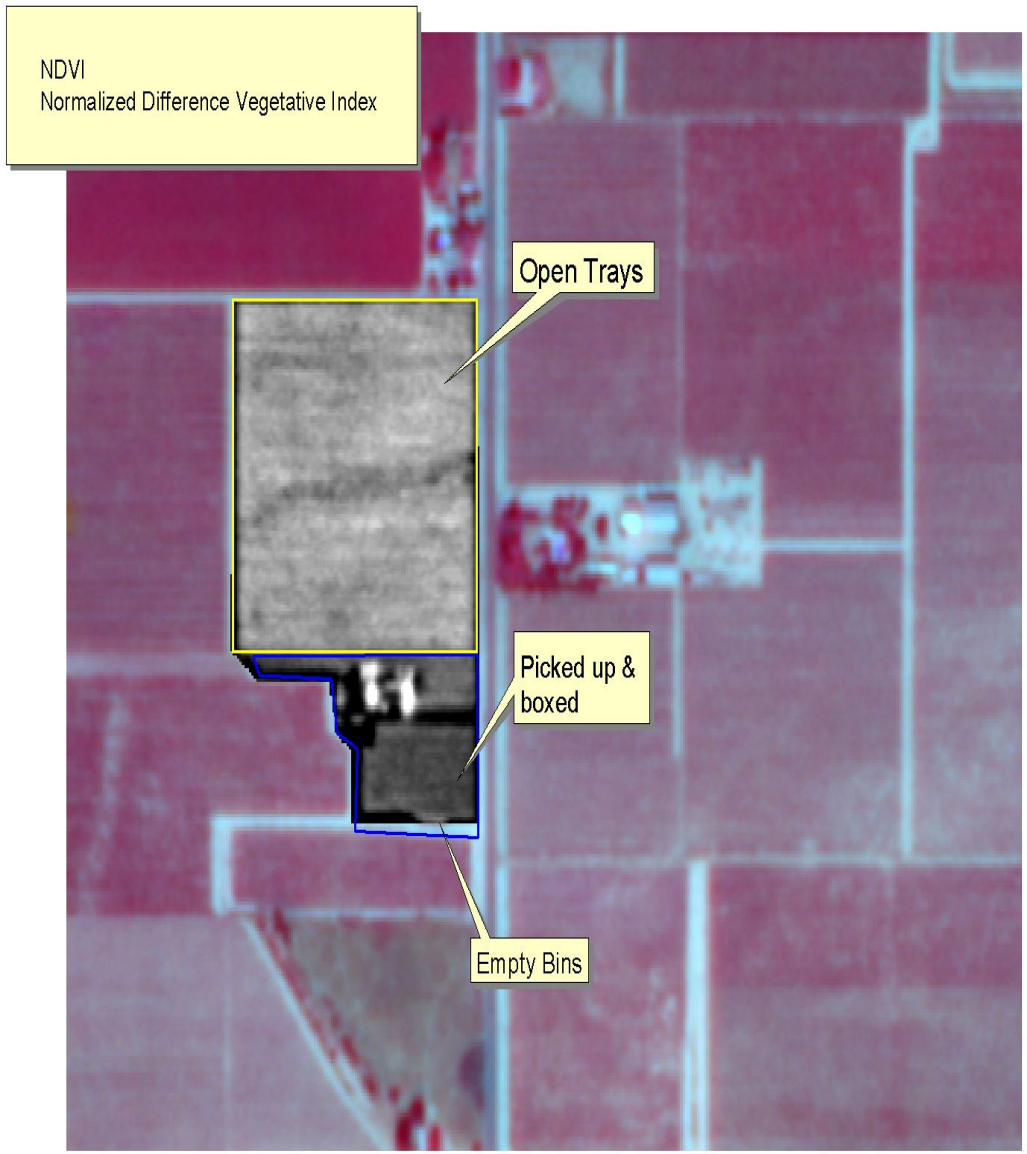
Aerial Infrared Program: Raisins, 2002



- Upper 2/3 of the vineyard
- appears darker in this
- image because the open
- trays on the ground
- absorb more red light.

- The lower portion of the
- vineyard around the house
- appears lighter because
- the bare ground reflects
- more of the red light.

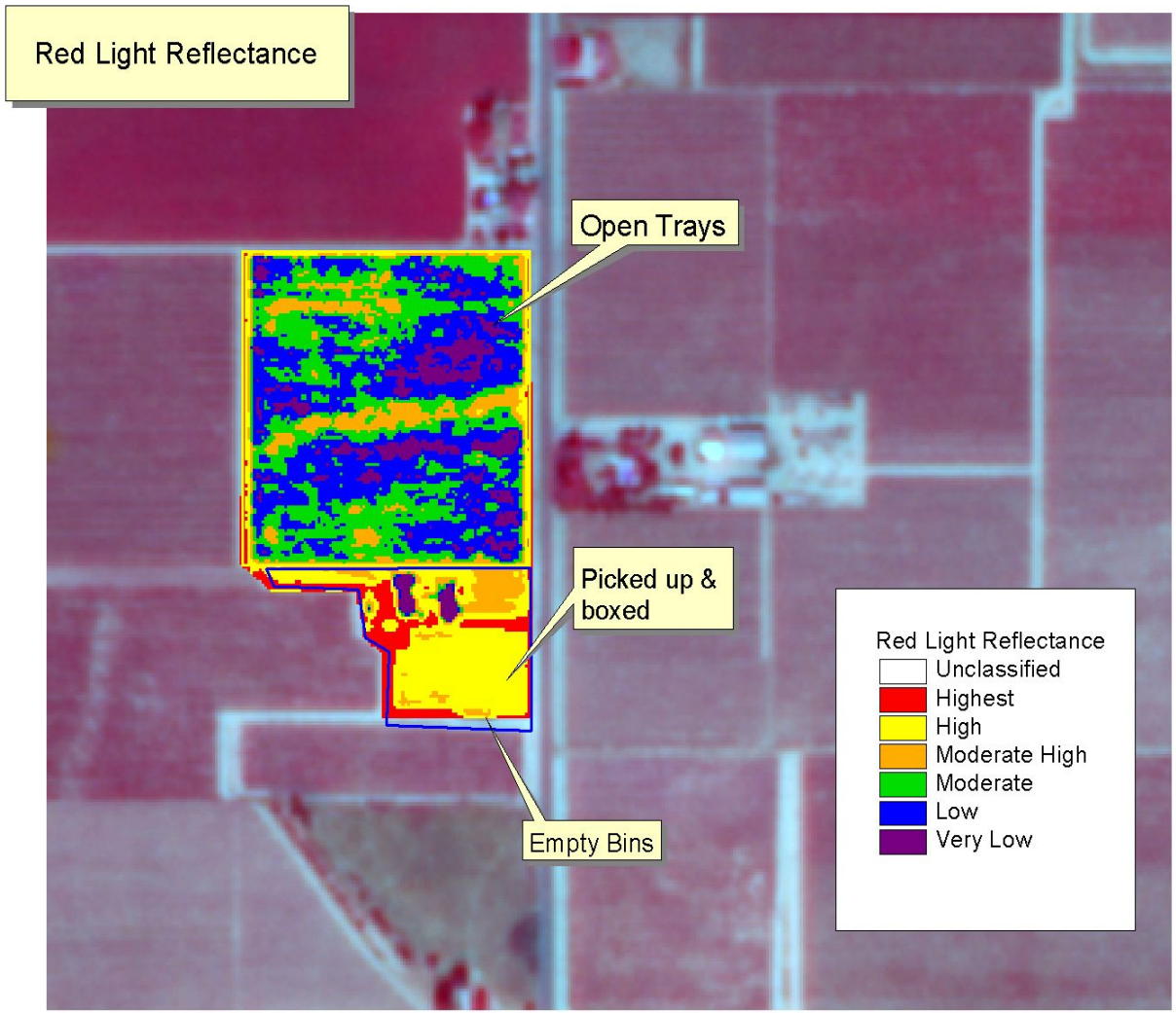
Aerial Infrared Program: Raisins, 2002



- Because there are raisins on the
- ground in the upper 2/3 of
- vineyard, the image appears
- lighter because it reflects a
- lower level of red light
- (more red light absorbed).

- Lower portion is darker because
- the bare ground reflects more
- light.

Aerial Infrared Program:
Raisins, 2002



Color Vigor Map

This image shows the breakdown of the NDVI image into 6 color categories representing various levels of vigor (based on the amount of red light reflectance).

Northern end with open trays still on the ground absorb a higher amount of red light.
(Low Reflectance)

Southern end where trays have been picked up and removed from the field absorb lower levels of red light.
(High Reflectance)

Conclusions

- need to educate jury on RS and establish RS digital image processing as scientific and rigorous
- an analysis that helps establish timeline of events
- jury often remark that the RS evidence was important
- reinforced what was being told in the various charts/graphs/testimonies
- “picture is worth 1000 words”